Scientific Inquiry

4-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.

4-1.6 Construct and interpret diagrams, tables, and graphs made from recorded measurements and observations.

Taxonomy Level: 2.7 and 2.1 Understand Conceptual Knowledge

Previous/Future knowledge: In previous grades, students have used tools (specific to each grade) to accurately gather data appropriate data. In 2nd grade (2-1.3), students represented and communicated simple data and explanations through drawings, tables, pictographs, bar graphs, and oral and written language. In 5th grade (5-1.5), students will construct a line graph from recorded data with correct placement of independent (manipulated) and dependent (responding) variables. This is the first time that students have constructed their own diagrams, tables, and graphs.

It is essential for students to construct simple diagrams, tables and graphs (such as pictographs, bar, or line) from recorded measurements and observations.

A *diagram* is a drawing or illustration that communicates information visually. Diagrams should contain the following:

- A title or description of the object or item modeled by the diagram telling what the drawing or illustration is about
- Labels of the main points of information that help identify what is in the drawing or illustration
- A caption that explains the drawing or illustration.

A *data table* is used to organize data collected in an experiment so that it can be read easily.

- A data table should be planned before the investigation starts.
- Consider the purpose of the table, the kind and number of items to be included in the table, the number of times a measurement will be made, and the units to be used.
- Data tables are often organized in columns and rows. The columns should have headings that show the quantity and unit of the data in that column.
- The manipulated variable is listed in the column on the left side. The responding variable is listed in the column(s) on the right side.
- If qualitative data is to be gathered, include enough space to write the observations.

Graphs are visuals used to compare data. Graphs show not only information but also relationships between the data. Graphs should include:

- a labeled x-axis (with a manipulated variable) and y-axis (with a responding variable) with appropriate units
- a scale on each axis that is appropriate for the data being graphed
- a title related to the data being graphed

Different types of graphs show different types of information.

- Pictographs use pictures of objects to show quantities.
- Bar graphs are often used to compare the quantities of different qualitative factors.
- Line graphs are often used when quantitative data collected over time.
- Line graphs show how quantitative data changes over time or relationships between manipulated (changing) variable and responding (resulting) variable.

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NOTE TO TEACHER: Students should be plotting data on graphs that already contain the increments for the given data sets. Constructing graphs in 4th grade should be limited to labeling the variables on the x-axis and y-axis and plotting data. Graphs should include increments and titles.

It is also essential for students to interpret data displayed in diagrams, tables, and graphs (pictographs, bar, line, or circle).

- Diagrams can be used to identify specific parts or how they work, sequence of events, how things are alike and different, or the relationship among objects or events.
- The lines on a line graph show the pattern of changes at a glance.
- The length of the bars on a bar graph shows the quantity or amount of the qualitative factors.
- Circle graphs show parts of a whole. They make it easy to tell which is the biggest, which is the next biggest, and so on.

It is not essential for students to construct circle graphs. Students do not need to determine the increments for nor provide a title for a graph.

Assessment Guidelines:
One objective of this indicator is to *construct* diagrams, tables, and graphs made from recorded measurements and observations; therefore, the primary focus of assessment should be to arrange information recorded from measurements and observations correctly onto the appropriate display as listed in the indicator. However, appropriate assessments should also require students to *identify* the correct placement of variables on graphs and data tables; *identify* the parts of diagrams; *compare* data tables with appropriate graphs or diagrams; or *exemplify* types of graphs.

Another objective of this indicator is to *interpret* diagrams, tables, and graphs made from recorded measurements and observations; therefore, the primary focus of assessment should be to translate the data represented on diagrams, tables, and graphs. However, appropriate assessments should also require students to *summarize* diagrams, tables, and graphs made from recorded data; or *explain* information in diagrams, tables, and graphs.